(No Model.) 3 Sheets—Sheet 1

N. O. GOLDSMITH.

ELECTRIC DOUBLE SEMAPHORE BLOCK SIGNAL.

No. 536,871. Patented Apr. 2, 1895.

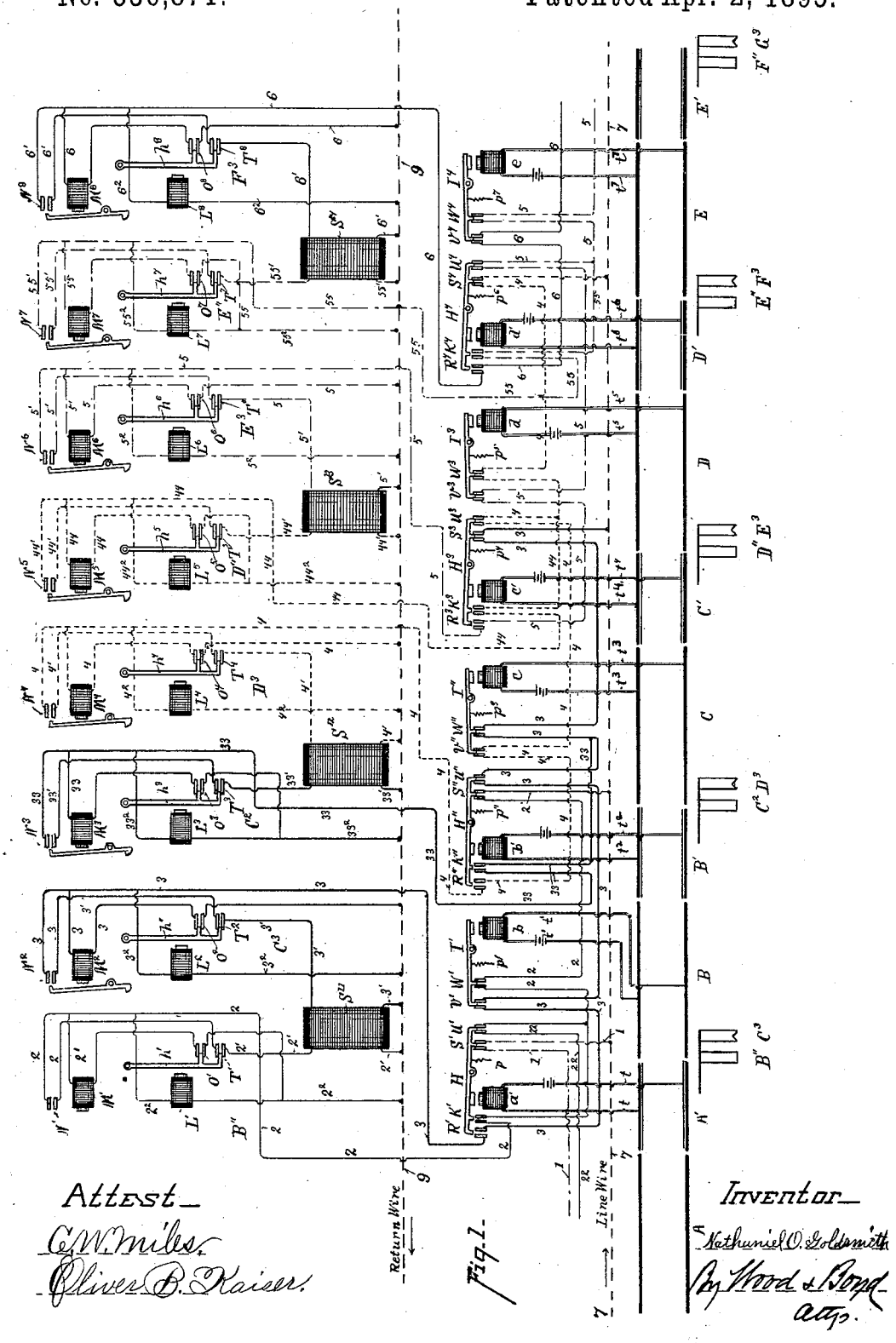

Fig. 1.

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(No Model.) 3 Sheets—Sheet 2.

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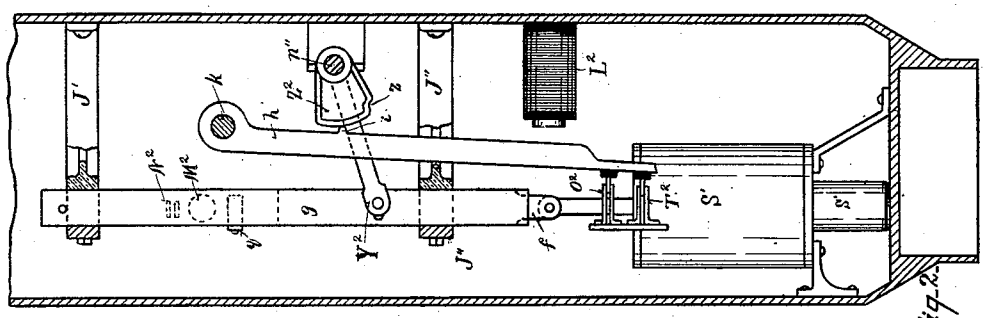

Fig. 2.

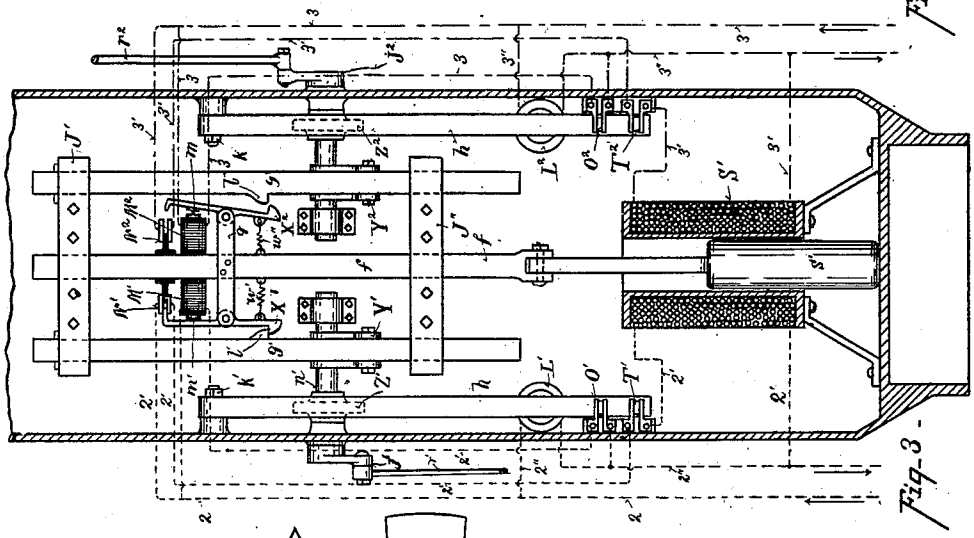

Fig. 3.

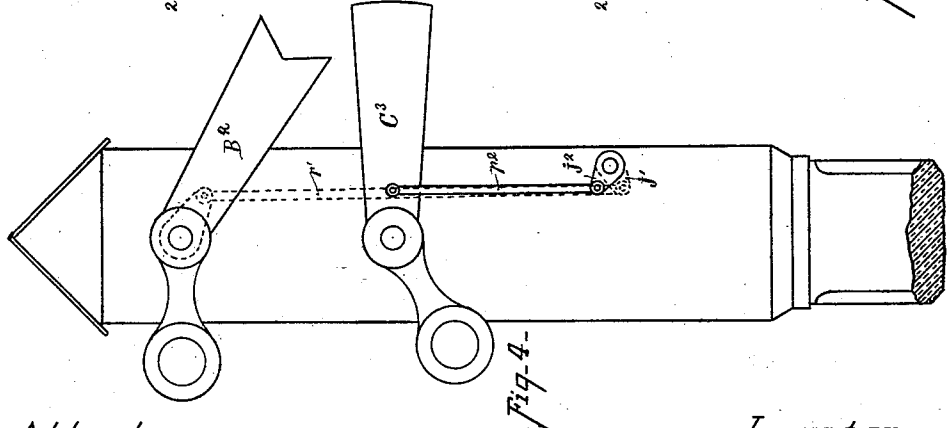

Fig. 4.

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N. O. GOLDSMITH.

ELECTRIC DOUBLE SEMAPHORE BLOCK SIGNAL.

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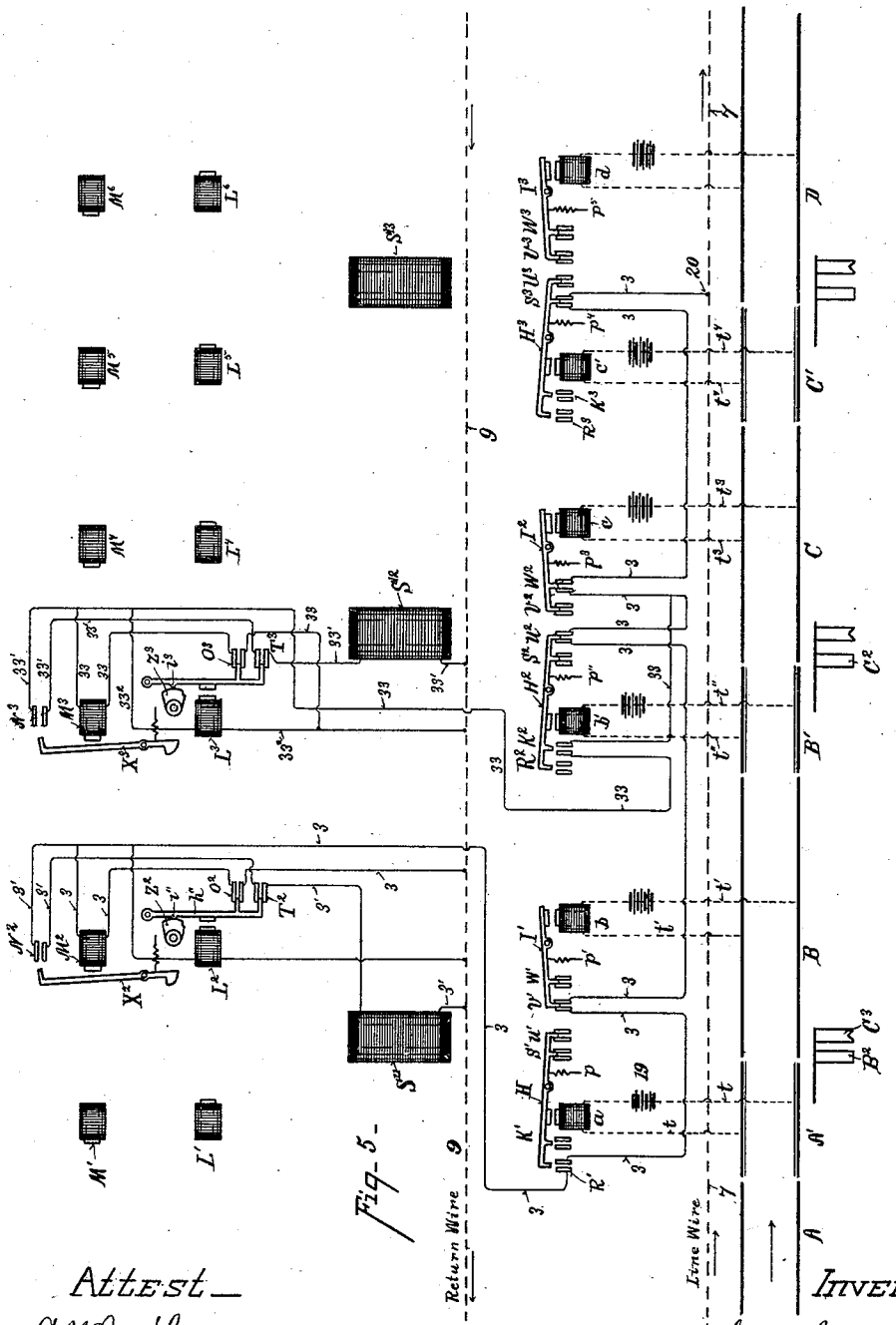

Fig. 5.

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UNITED STATES PATENT OFFICE.

NATHANIEL O. GOLDSMITH, OF CINCINNATI, OHIO.

ELECTRIC DOUBLE-SEMAPHORE BLOCK-SIGNAL.

SPECIFICATION forming part of Letters Patent No. 536,871, dated April 2, 1895.

Application filed March 24, 1894. Serial No. 504,949. (No model.)

To all whom it may concern:

Be it known that I, NATHANIEL O. GOLDSMITH, a citizen of the United States, residing at Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Electric Double-Semaphore Block-Signals, of which the following is a specification.

The object of my invention is to provide an automatic signal for railroads, which when adjusted to be worked on the normally danger principle, by electricity, can be so arranged that the signal of a particular block on which the train enters, will not go to safety until the two preceding sections are clear of trains.

Another object of the invention is to provide means for automatically locking the signals by the control of the circuit breaking mechanism for either one or two blocks in the rear of the train, as the case may be.

Another object of my invention is to employ the double signal, or what is sometimes called the overlapping signal, by which the signals are held to the danger position for two or even three preceding blocks, one of them going to safety say when one preceding block is clear, and the second or distant signal going to safety when the second train is two blocks in advance.

Another object of the invention is to divide each block into two sections, one section controlling the circuit for locking the signals in the rear, and the other section of the block not only controlling the locking of the rear section, but controlling the circuit of the preceding block, allowing its signal to go to safety. Thus the circuits for locking the signals at danger, and the circuits for moving the signals to safety are controlled automatically by the electrical connection formed through the train on the different blocks and sections.

Another object of my invention is to employ a signal moving mechanism consisting of the prime mover and shipping mechanism adapted to connect and disconnect with the prime mover the signal moving mechanism so that either one or two signals may be moved as determined by the circuit connections and magnets which control the movement of the shipping mechanism.

The various features of my invention are fully set forth in the description of the accompanying drawings, making part of this specification, in which—

Figure 1 is a diagram of one track of a double track, having three blocks of two sections, and indicating the position of the signals, the track instruments, and circuit terminals, and the general plan of wiring the said system. Fig. 2 is a side elevation of one of the signal boxes with the mechanism contained therein, having one side of the case removed. Fig. 3 is a front elevation of one of the signal boxes with the side of the case removed showing the mechanism for working two signals. Fig. 4 is a front elevation of the signal box and signals. Fig. 5 is a diagram similar to Fig. 1, showing the operation when one set of signals is employed.

When the two signals are operated it is necessary to establish two signal circuits through the circuit making and breaking mechanism of either section of the block, and this double circuit connection is shown in diagram Fig. 1. The diagram in Fig. 5 illustrates the circuit and connections when only one signal of each block is to be used. The signal mechanism is operated by electricity applied either through a solenoid or an electric motor, or any other well known electrical power. As the preferred form of construction I have shown one main feed wire 7, with the return wire 9 completing the circuit by which electricity is supplied to all the circuits established in the system. I have shown a solenoid as a motor for moving the signal device; magnets and armatures for holding the signals in the safety position; the signals being counterweighted to be held at danger as shown in Fig. 4. I have also shown a series of magnets and circuit breakers operated by what may be termed a track circuit, that is, a circuit which is closed when the wheels of the train are on any two rails of the section. I have also shown magnets and armatures applied for locking or holding out of engagement one set of signal moving devices, and allowing the other signal to be moved; and this operation of the signals is controlled by the making and breaking of the track circuits in the block system.

Referring to Figs. 2 and 3, S^{11} represents an

electro magnet or solenoid provided with the plunger s' and connected to the rod f by means of a hinge-joint. This solenoid is rigidly attached to the inside of the signal case. The rod f is guided in bearings J', J^2, and allowed to move vertically without rotating. It acts as the prime mover of the signal moving mechanism, and in the preferred form of construction is supported in bearings or guides J' and J^2, which are attached to the signal case. Fastened to the rod f is a cross arm q, and at the ends of arm q are pivoted arms X', X^2. The lower end of each of these arms is provided with a hook, and the upper end with a contact breaker, which makes or breaks the contacts N' and N^2 respectively. Opposite the hooks on the lower end of the arms X' and X^2 are attached springs w' w^2, which normally pull the hook ends of the arms X' X^2 toward the rod f. By so doing, the contacts N' and N^2 are broken. Attached to this same rod f and directly above the cross arm q are two electro magnets M' and M^2. These are directly opposite the upper part of the pivoted arms X' and X^2, and when these electro magnets M' and M^2 are energized, they attract the armatures m' and m^2 which are fastened to the arms X' and X^2 respectively, directly opposite the cores of the electro magnets M' and M^2, and in this way the contacts N' and N^2 are made.

The arms X' X^2 and the magnets M' M^2 constitute shipping mechanisms which are electrically controlled so as to move either one or both signals as the said magnet circuits are closed by the respective signal circuits 2 and 3.

g and g' represent two rods sliding in the guides J' and J^2 and provided with lugs l and l' respectively. These lugs engage with the hooks on the lower ends of the pivoted arms X' and X^2, when the magnets draw the armatures m', m^2, into position for contact. The rod g' is hinged to a crank lever Y', which is fastened to a shaft n'. To this shaft is attached a cam Z' and also a crank j'. To the opposite end of this latter crank is a connecting rod r' running to the signal blade B^2. The shaft n' is supported in bearings fastened to the signal case, and one end of the shaft n' passes through the side of the case as shown in Fig. 3. The rod g is connected in the same way to the crank Y^2, which is fastened to the shaft n upon which is cam Z^2, and outside of the case the crank j^2 with the connecting rod r^2, operating blade C^3. An arm h is pivoted at its extreme upper end to the case by means of the pin k. This arm h is provided with a lug i which rests against the periphery of the cam Z^2.

At the lower end of the arm h are two contact breakers O^2 T^2. Directly above these contact breakers and in line with the arm h is an electro magnet L^2, which is fastened to the case. On the lower corner of the cam Z^2 is a notch z' into which the lug i on the arm h can drop when the cam Z^2 revolves into its uppermost position. If at this instant a current is passing through the electro magnet L^2 the lower end of the arm h is attracted and held to the core of the electro magnet L^2. The result is that the cam Z^2 cannot drop down because it is held by the lug i on the arm h and thus the contacts O^2 and T^2 are broken. Hence the signal blade which is operated by the crank shaft n will be held down into an inclined or safety position so long as magnet L^2 is energized. The operation of the pivoted arm h' is precisely the same as that just described for the arm h.

In the drawings shown in Fig. 5 three blocks are shown; A A', B B', C C'. Each section is shown as properly connected up with the circuit breakers by means of wires which are arranged as follows: Sections A', B' and C' are shown adapted to operate as signal moving circuits and locking circuits, while sections B, C, D, are shown as adapted to be employed as locking circuits only. If the sections B B', C and C', are clear of trains, when a train enters section A' it will close the track circuit, which track circuit closes the signal moving circuit mechanism, as follows: The train closes the track circuit t, and energizes the magnet a, which is preferably operated by a battery 19, so as to have a circuit of low tension. Magnet a pulls down the armature H', closes the circuit terminal R, and the circuit is established from junction 20 by wire 3, through the terminals S^3, W^2, U^2, V', R, thence by wire 3 to magnet M^2, thence through said magnets to terminals O^2, T^2, thence through the solenoid S' to line 9. The solenoid S' operates the signal moving mechanism, operating signal C^3, as before described. As soon as the train leaves the section of block A' and enters upon the rails B of the next section, the armature H' goes back to normal position being pulled by the spring p. Magnet b is in another track circuit operated by a battery which is closed similar to the preceding one, pulling down armature I', breaking the circuit 3 at V', and allowing the signal C^3 operated through the section A' to go back to danger. So long as said magnet b is energized the signal C^3 cannot be moved as it is permanently broken at V'. As soon as the train, however, has passed on to section B' this armature I' will go back to the normal position, shown in Fig. 5, and the circuit will be established; but I provide mechanism for breaking the circuit 3 again by the closing of the circuit t^2 of the magnet b' which energizes said magnet, operates the armature II^2 and breaks the circuit at U^2; and as arranged this circuit 3 is again broken at S^3 when the train enters the section C. Another track circuit is closed in which magnet c is connected, which operates the armature I^2, breaking the circuits 3 and 33 at W^2. When the train reaches section C' circuit t^3 is made and contact S^3 broken. Hence, before the signal which was first moved by closing the track

circuit A′ can be again operated sections B B′, C C′ must be entirely clear. Signal C^3 is operated in a similar manner by establishing a circuit through magnet b' and making the circuit 33, and bringing in solenoid S^2 to operate the signal C^2.

When it is desired to operate two signals, one signal, say C^3, is operated by the closing of the track circuit A′, and the signal B^2 is operated when track C is clear.

When the two signal blades are to be operated I provide a second set of circuits made and broken through the same armatures H′, H^2, H^3. These circuits are established through the terminals K′ U′ W′ S^2; and the remaining circuits, in like manner, are made and broken by the trains going over the succeeding block sections.

The operation of this signal mechanism is as follows: First, imagine the two signal blades in a horizontal or danger position and the parts of the mechanism in normal position, that is, the plunger s' would be in its lowest position as shown in Figs. 2 and 3. The hooked end of the pivoted arms X′ and X^2 are pulled by their springs w' and w^2 toward the rod f, the contacts N′ and N^2 are broken, the rods g and g' are in their lowest positions, the pivoted arms h and h' are resting on the faces of the cams Z′ and Z^2, and the contacts O′ and T′ and O^2 and T^2 are made. Now if a current passes from the line through the wire 2, it will energize the magnet M′, throwing the hooked end of the arm X′ away from rod f, extending the spring w' and making the contact N′. After the contact N′ is made, the current can then pass through the wire 2′ down through the contact T′ into the solenoid S^{11} and out through the return over the line 2′. The electro magnet L′ is energized by means of the current passing from the line 2″ out to the return over the line 2. When the solenoid S^{11} is energized, the plunger s' rises; lifting the rod f, and the hook on the arm X′ comes in contact with the lug l', raising the rod g' and revolving the cam Z′ and the crank j'. This pulls one signal blade to an inclined or safety position by means of the connecting rod r'. When the signal is in its lowest position the cam Z′ is in its uppermost position, and the lug i' on the arm h' passes into the notch z' of the cam Z′, the position of which parts is illustrated by the corresponding parts in Fig. 2. The electro magnet L′ being energized holds the arm h' against its core. This movement of the arm h' breaks the contacts O′ and T′. Breaking the contact O′ de-energizes the magnet M′, and breaking the contact T′, de-energizes the solenoid S^{11}. Thus one signal blade is held in a safety position by the energized magnet L′ acting upon the arm H′ which in turn holds the cam Z′. If at the time the current passes through the line into the wire 2, a current also passes from the line into the wire 3, the magnet M^2 will be energized, the pivoted arm X^2 attracted thereto and the rod g will be raised, and the second blade turned to a safety position at the same instant the first blade is turned. This second blade is held there by means of the energized electro magnet L^2. Thus either one or both blades may be pulled by means of one solenoid S^{11}. While the blades are in a safety or inclined position, and are held by the energized magnets L′ and L^2, they may be returned by gravity to the horizontal or danger position, whenever the circuits 2 and 3 are broken which cuts out the electro magnets L′ and L^2. They will stay in that danger position until the circuits are re-established and operated as before described.

In Fig. 1 the magnets M′ M^3 M^5 M^7 correspond to the magnet M′, Fig. 3, and the magnets M^2 M^4 M^6 and M^8 correspond to the magnet M^2, Fig. 3. The same applies to magnets L′ L^3 L^5 and L^7 corresponding to the magnet L′, Fig. 3, and L^2 L^4 L^6 and L^8 correspond to magnet L^2, Fig. 3.

In Fig. 1 the solenoid S^{11} operates the two signals B^2 and C^3, the solenoid S^{12} operates the two signals C^2 and D^3; solenoid S^{13} operates the signals D^2 and E^3, and solenoid S^{14} operates signals E^2 and F^3. To illustrate the working of this system we will imagine no train in any block and all the signals normally at danger, as shown in Fig. 1, no current passing through the track circuits t, t', t^2, &c., and the contacts controlled by the springs p, p', p^2 and p^3, &c., are made. Suppose a train appears in the section A, running toward the section A′. The instant the first pair of wheels touch the rails of the section A′, a current will be sent through the track circuit t, because it will be closed by means of the car wheels and axles. This will energize the electro magnet a'. The armature of the arm H′ will be drawn toward the core of the electro magnet a', making the contacts R′ and K′ and breaking the contacts S′ and U′. If neither of the sections B or B′ of the block just ahead of the train, nor the sections C or C′ of the second block ahead of the train are occupied, then both of the signal arms B^2 and C^3 will go to a safety position when the train first enters the section A′. The passage of the current under these conditions is as follows: Flowing along the line 7 until it comes to the wire 2, it passes by the wire 2 through the contact S^2 down along the line 2 to the contact W′, along the line 2 to the contact K′, thence along the line 2 through the electro magnet M′ and the contact O′ to the return wire 9. As described previously, the energizing of the magnet M′ makes the contact N′, passes the current through this contact along the line 2′ to the contact T′, then through the line 2′ to the solenoid S^{11} and out to the return 9 over the line 2′. At the same instant the electro magnet L′ is energized through the line 2″. Simultaneously, a current is passing along the line 7 to the wire 3, then through the contact S^3 along the

line 3 to the contact W^2, then along the line 3 to the contact U^2, along the line 3 to the contact V', along the line 3 to the contact R', thence along the line 3 to the electro magnet M^2 to the contact O^2, and then to the return, also energizing magnet M^2 which makes the contact N^2, and energizing the solenoid S^{11}. Thus both of the hooked shipping arms X' and X^2 in Fig. 3 are thrown out into a position to engage the lugs l' and l on the rods g and g' and therefore pulling both signals B^2 and C^3. By both signals taking a safety position the train is permitted to proceed, along the section A' into the section B, passing the signals B^3 and C^3 while they are in a safety position, in which condition they remain until the last pair of wheels has passed out of the section A'. At this instant the signals B^2 and C^3 go back to danger because circuits 2 and 3 are broken at R' K' by the de-energizing of magnet a' allowing the armature H' to go back to normal. The moment the train enters the section B, the track circuit t' is completed, the magnet b energized, the armature of the arm I' is attracted, and the contacts V' and W' are broken. The breaking of these contacts lock the signal arms B^2 and C^3 in a danger position, because the breaking of the contact V' breaks the line 3, and the breaking of the contact W' breaks the line 2, and the signals cannot be moved until the circuits are re-established. When the train passes from the section B into the section B', the signal arms C^2 and D^5 will go to safety position if the two blocks ahead are clear, but the signals B^2 and C^3 behind the train will still remain in a danger position until the train has passed from the section B' into the section C. The reason the signals B^2 and C^3 remain in a danger position when the train enters the section B', is because the electro magnet b' is energized by the track circuit t^2 which makes the contacts R^2 K^2 on the arm H^2, and breaks the contacts S^2 and U^2. These latter contacts S^2 and U^2 are in the lines 2 and 3 respectively. So, notwithstanding the fact the contacts V' and W' were made the instant the train left the section B, the breaking of the contacts S^2 and U^2 which occurs before the last wheel of the train has left the section B, still keeps a break in the lines 2 and 3. However, the instant the train enters the section C, the electro magnet c becomes energized by the track circuit t^3, breaks the contacts V^2 and W^2 and when the last wheel passes out of the section B', the contacts R^2 and K^2 become broken, and the contacts S^2 and U^2 are made. This unlocks the home signal B^2 but still locks the distant signal C^3, and the home signal C^2 and distant signal D^3. The distant signal C^3 is still locked in a danger position, because the contact W^2 is broken, which breaks the line 3. This contact W^2 also breaks the line 33, which line controls the home signal C^2, locking it in a danger position. The contact V^2 being broken, breaks the line 4 which controls and operates the distant signal D^3. Thus when the train is in the section C, the signals C^3, C^2 and D^3 are locked in a danger position. When the train passes into the section C' and two blocks are clear ahead of it, the signals D^2 and E^3 go to safety, while the signals C^3, C^2, and D^3 still remain locked at danger. However, when the train enters section D, and leaves the section C', the signals C^3 and C^2 become unlocked, and the signals D^3, D^2 and E^3 become locked. The reason that the signals C^3 and C^2 are unlocked when the train enters the block D and leaves the block C', is because all the contacts in the line 3 are made by the action of the springs p, p', p^2, p^3, p^4, and the reason that the signals D^3 and D^2 are locked to danger, is because the electro magnet d' is energized by the track circuit t^5, and the contacts V^3 and W^3 are broken; thus making a break in the line 4, which operates and controls the signals D^3 and D^2, locking them at danger. The signal E^3 is locked at danger because of the break in line 5 at the contact V^3.

The passage of the train just described has been through a series of clear blocks; that is, no train in any of the blocks ahead. We will now imagine a train, No. 1, to be running in the block A, while a train, No. 2, is running in the same direction in the block B. When the train, No. 1, in the section A enters the section A' it closes the track circuit t which energizes the magnet a'. Thus the contacts R' and K' are made, and the contacts S' and U' are broken; but if train No. 2 is in the block B the track circuit t' is also closed, and the electro magnet b is energized, and the contacts V' and W' are broken. The breaking of the contacts V' and W' breaks the lines 2 and 3, and for this reason the signals B^2 and C^3 do not go to safety when train No. 1 enters the block A'. If train No. 2 happens to be in the section B' when train No. 1 enters section A', the track circuit t^2 will be made, and the electro magnets b' energized, closing the contacts R^2 and K^2 and breaking the contacts S^2 and U^2. This break of the contacts S^2 and U^2 breaks the lines 2 and 3, and thus the signals B^3 and C^3 still remain at danger if train No. 2 is in the section B' when train No. 1 enters the section A'. When train No. 1 enters A' and does not get a safety signal it is of course obliged to stop and wait in front of the signal post until one or both of the signals go to safety. The lower or home signal B^2 will go to safety the moment the last wheel of train No. 2 leaves the section B', entering the section C, because the track circuit t^2 is broken, the electro magnet b' is de-energized, the spring p^2 acts closing the contacts S^2 and U^2, and breaking the contacts R^2 and K^2, but the moment train No. 2 enters the block C, the electro magnet c is energized, and the contacts V^2 and W^2 are broken. The contact W^2 breaks the line 3 which is the line

controlling signal C^3. Therefore signal C^3 remains at danger, but the line 2 is now complete, so that the current can pass along the line 2 through the contact S^2, and the contact W′, and the contact K′ into the signal mechanism, pulling down the signal B^2 into a safety position. Train No. 1 in the section A′ can now proceed into and through section B, and run to the section B′. If when entering the section B′ one or both of the signals C^2 and D^3 come to a safety position, they can enter the section C, but if both signals remain at danger, the train No. 1 must stop until the signal C^2 is cleared. Of course, it is readily understood that if train No. 2 is in the section C proceeding toward C′, while train No. 1 is in the section A, proceeding toward A′, and train No. 1 reaches A′ before train No. 2 leaves the sections C and C′, then only the signal B^2 will come to safety, and the signal C^3 will remain at danger. Thus two signal blades on the same post at danger indicate a train in the next preceding block, and a distant signal blade at danger and a home signal blade at safety, would indicate a train in the second preceding block. Both signal blades at safety would indicate at least two blocks clear.

Having described my invention, what I claim is—

1. A railway block signal device consisting of two or more track circuits each operating an armature and magnet, two signal circuits each having terminal connections made through said armatures, signal mechanism operated by said circuits whereby said signals are each controlled by trains on each sub-section and adjacent sub-sections, substantially as specified.

2. A railway block signal device consisting of three or more local track circuits each operating an armature and magnet, two signal circuits each having terminals controlled by the armatures of each of said magnets, two sets of signal mechanism, magnets for controlling the mechanism of each signal, and terminals controlled through said magnets of the signal moving mechanism, substantially as specified.

3. In a railway signal mechanism two parallel signal circuits 2, 3, in combination with two or more local track circuits, each local track circuit operating an armature having two terminals for each of said signal circuits, substantially as specified.

4. In a railway signal system consisting of blocks divided into sub-sections, two signal circuits for each block, each controlled by armatures of the track-circuit magnets, one of said track circuit armatures having terminals for each preceding signal-circuit, and terminals for signal circuits of its own block, substantially as specified.

5. In a railway block signal mechanism consisting of sub-sections, the combination of two or more track-circuits adapted to be controlled by trains on the rails each operating a magnet and armature, two parallel signal circuits having terminals through said armatures, one of said armatures having terminals for making and breaking the signal circuit alternately, and the other armature terminals for making and breaking the said circuit, whereby the signals of each block are operated automatically by the trains to indicate their position on adjacent blocks, substantially as specified.

6. In a signal moving mechanism consisting of the signal circuit, an arm *f* operated by a power device in the signal circuit, a magnet M′ in said circuit, catch mechanism connected with said arm and operated by said magnet, and mechanism for transmitting motion from said catch mechanism to the signal shaft, substantially as specified.

7. In a signal moving mechanism, the combination of two signals each electrically operated by a prime mover, two sets of catch mechanism operated respectively by signal circuits 2, 3, and containing a magnet and terminal in each of said circuits whereby either one or both of the catch mechanisms can be operated by the appropriate closing of said circuits, substantially as specified.

8. In a signal moving mechanism operated by signal circuits, the arms *f*, catch mechanism, magnet M′, and terminals N′, so connected in the signal circuits that the prime mover is operated subsequent to the energizing of said magnet M′, and mechanism for transmitting motion from the catch mechanism to the signal shaft, substantially as specified.

9. In combination with a signal moving mechanism having a prime mover operated by a signal circuit, the shipping mechanism operated by a magnet in said circuit, and locking mechanism and its terminals operated by a second magnet L, whereby the shipping and locking mechanisms are successively operated by the signal circuit, substantially as specified.

10. In a railway signal mechanism consisting of blocks divided into sub-sections, two parallel signal circuits 2, 3, each having terminal connections through the armatures of magnets operated by track circuits, a signal moving device operated by each of said circuits, shipping and unshipping mechanism operated electrically by said circuits, whereby either one or both signals of a block are operated and the signals of each adjacent block are controlled, substantially as specified.

11. In a railway signal system, the combination of parallel signal circuits, a signal moving mechanism consisting of an electric-motor, a crank-shaft operated by said motor, terminals for the signal circuits, a magnet and armature in each signal circuit, means for holding said armatures away from said magnets during a part of the crank-shaft move-

ment, and devices for bringing each into operation to break its circuit at the end of the movement, substantially as described.

12. An electric signal moving mechanism, consisting substantially of an electric motor, a crank-shaft operated by said motor, two signal circuits having terminals controlled by said crank-shaft, and magnets and armatures in track circuits for making and breaking said signal circuits at appropriate times automatically by the movements of a train, substantially as described.

In testimony whereof I have hereunto set my hand.

NATHANIEL O. GOLDSMITH.

Witnesses:

T. SIMMONS,

W. R. WOOD.